3. The process of claim 2, wherein the catalyst comprises at least one of iron, cobalt, nickel, titanium, molybdenum, tungsten, aluminum, potassium, cesium, calcium, magnesium, barium, zirconium, osmium, uranium or a lanthanide, ruthenium, platinum, palladium, or rhodium.

4. The process of claim 2 wherein the catalyst comprises a ruthenium species.

5. The process of claim 2 wherein the catalyst comprises a nickel species.

6. The process of claim 2 wherein the catalyst is provided as at least a powder, granules, foil, a coating, bulk material, or a porous pellet.

7. A process for growing a crystalline gallium-containing nitride, the process comprising:

providing a high pressure apparatus comprising gallium-containing feedstock in one zone, at least one seed in another zone, an azide mineralizer, at least one metal, and a catalyst within a vicinity of either or both the one zone or/and the other zone, the azide mineralizer and the metal being provided in a predetermined ratio such that nitrogen generated by decomposition of the azide mineralizer and a hydrogen gas species generated by reaction of at least the metal with a supercritical ammonia are in a ratio of approximately 1:3 and greater;

processing one or more portions of the gallium-containing feedstock in the supercritical ammonia to provide a supercritical ammonia solution comprising at least gallium containing species at a first temperature;

growing crystalline gallium-containing nitride material from the supercritical ammonia solution on the seed at a second temperature, the second temperature being characterized to cause the gallium containing species to form the crystalline gallium containing nitride material on the seed;

generating the hydrogen gas species from at least the reaction between the metal and the supercritical ammonia fluid; and

processing the hydrogen gas species using at least the catalyst to convert the hydrogen gas species and a nitrogen gas species to the supercritical ammonia fluid.

8. The process of claim 7 wherein the processing of the hydrogen gas species and the nitrogen gas species is governed by $N_2+3H_2=2NH_3$.

9. The process of claim 7 wherein the ratio of approximately 1:3 ranges from about 0.8:3 to 1:3.8.

10. The process of claim 7 wherein the ratio of approximately 1:3 ranges includes any ratio greater than 1:3.

11. The process of claim 7 wherein the ratio of approximately 1:3 ranges from about 0.9:3 to 1:3.3.

12. The process of claim 7 wherein the catalyst comprise a nickel species.

13. The process of claim 7, wherein the catalyst comprises at least one of iron, cobalt, nickel, titanium, molybdenum, tungsten, aluminum, potassium, cesium, calcium, magnesium, barium, zirconium, osmium, uranium or a lanthanide, ruthenium, platinum, palladium, or rhodium.

14. The process of claim 7 wherein the catalyst comprises a ruthenium species.

15. The process of claim 7 wherein the catalyst is provided as at least a powder, granules, foil, a coating, bulk material, or a porous pellet.

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